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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/457,929	12/08/1999	JACK CHIHCHIEH YAO	A-64873-1/AJ	8226

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EXAMINER	
LUND, JEFFRIE ROBERT	
ART UNIT	**PAPER NUMBER**
1763	20

DATE MAILED: 02/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

FILE COPY

Office Action Summary	Application No.	Applicant(s)	
	09/457,929	YAO ET AL.	
	Examin r	Art Unit	
	Jeffrie R. Lund	1763	

-- Th MAILING DATE of this communication appears on the cov r sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 December 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6,8,10 and 11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 December 1999* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. Claims 1, 3, 4, 6, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over McDiarmid US patent 5,242,501, in view of Inoue et al, 5,677,253, or Grabmaier et al, US Patent 3,151,006.

McDiarmid teaches a circular plate susceptor (wafer carrier) 216, 316 that has a flat edge extending around the circumference of the plate, and a circular recess center region 220, 320 having a recessed bottom surface 222, 322 and including an upwardly inclined surface 221, 321 around the periphery of the recess bottom. The substrate is supported by a portion of the upwardly inclined surface and is spaced apart from the recessed bottom surface such that the substrate is supported by the wafer carrier only around the periphery edge of the substrate (see column 4 lines 65-67). McDiarmid also teaches that the dimensions of the susceptor can be optimized to fit a variety of size substrates, and the space between the substrate and susceptor can be optimized to control the heat flow from the susceptor to the substrate. (Entire document)

McDiarmid does not teach that the wafer carrier is made out of silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy, the edge region has a width of 5 to 25 mm, the upwardly inclined surface is inclined at an angle of 5° to 45°, specifically, 10°, the recess is 200 mm or 300 mm (to fit a 200 or 300 mm substrate), or that the space between the back of the substrate is between 0.15 mm to 0.5 mm, specifically, 0.25 mm.

Inoue et al teaches a wafer holding member made of aluminum nitride.

Grabmaier et al teaches a carrier rod (wafer carrier) made of a highly pure silicon rod.

Silicon carbide, aluminum nitride, large-grained polycrystalline silicon and silicon/silicon carbide alloy are all well known materials of construction used in semiconductor processing apparatus, and all have been used for many years. Furthermore, graphite is known to introduce contaminants into the chamber i.e. carbon and is very vulnerable to chemical attack i.e. etching or oxidation.

The motivation for making the susceptor of McDiarmid out of silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy, as taught by Inoue et al or Grabmaier et al or as is known in the art, is to provide an alternate and equivalent material of construction; or an alternate and superior material of construction that is more stable and chemically inert to the reaction gases.

The motivation for sizing the recess to a specific size is to hold a specific size substrate, the motivation for optimizing slope of the incline and therefore the size of the space between the substrate and the susceptor is to optimize the heat flow between the susceptor and the substrate, both of which are taught by McDiarmid. The motivation for optimizing the size of the flat region is to optimize the heating of the outer edge of the wafer and optimizing the gas flow across the wafer. Furthermore, it was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not

perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04 (d))

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to: make the susceptor of McDiarmid out of silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy as taught by Inoue et al or Grabmaier et al or as is known in the art; size the recess to 200 or 300 mm; make the upwardly inclined surface an angle of 5° to 45°, specifically, 10°, to size the space between the susceptor to 0.15 to 0.5 mm, specifically, 0.25 mm; and to size width of the flat area of the susceptor to 5 to 25 mm.

2. Claims 1-4, 6, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacLeish et al, US Patent 5,891,251, in view of Inoue et al, 5,677,253, or Grabmaier et al, US Patent 3,151,006.

MacLeish et al teaches a circular plate susceptor (wafer carrier) 50 that has a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface 51c and including an upwardly inclined surface 51b around the periphery of the recess bottom; and a support member (lift pin) 54 to engage the substrate. The substrate is supported by a portion of the upwardly inclined surface and is spaced apart from the recessed bottom surface (about 0.08-0.13 mm) such that the substrate is supported by the wafer carrier only around the periphery edge of the substrate. (Entire document) MacLeish et al does not disclose any dimensions in the drawings, specification, or claims.

MacLeish et al does not teach that: the wafer carrier is made out of silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy, the recess is 200 mm or 300 mm (to fit a 200 or 300 mm substrate), the space between the back of the substrate is between 0.15 mm to 0.5 mm, specifically, 0.25 mm, the upwardly inclined surface is inclined at an angle of 5° to 45°, specifically, 10°, or that the flat edge region of the susceptor is 5 to 25 mm wide.

Inoue et al teaches a wafer holding member made of aluminum nitride.

Grabmaier et al teaches a carrier rod (wafer carrier) made of a highly pure silicon rod.

Silicon carbide, aluminum nitride, large-grained polycrystalline silicon and silicon/silicon carbide alloy are all well known materials of construction used in semiconductor processing apparatus, and all have been used for many years. Furthermore, graphite is known to introduce contaminants into the chamber i.e. carbon and is very vulnerable to chemical attack i.e. etching or oxidation.

The motivation for making the susceptor of MacLeish out of silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy, as taught by Inoue et al or Grabmaier et al or as is known in the art, is to provide an alternate and equivalent material of construction; or an alternate and superior material of construction that is more stable and chemically inert to the reaction gases.

One of ordinary skill in the art at the time the invention was made after reading the specification of MacLeish et al would be motivated to build the apparatus of MacLeish et al and find the optimum dimensions for each of the parts of the apparatus

to ensure that the apparatus would function as taught by MacLeish et al. Furthermore, it was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04 (d))

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to: make the susceptor of MacLeish out of silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy as taught by Inoue et al or Grabmaier et al or as is known in the art; size the recess to 200 or 300 mm; size the space between the susceptor to 0.15 to 0.5 mm, specifically, 0.25 mm; and to size the flat edge region of the susceptor to 5 to 25 mm.

Response to Arguments

3. Applicant's arguments with respect to claims 1-4, 6, 8, 10, and 11 have been considered but are moot in view of the new ground(s) of rejection.

In regard to the argument that there is no motivation to modify the MacLeish et al in combination with McDiarmid, the examiner agrees. No rejection was made which included any combination of McDiarmid and MacLeish et al. Both McDiarmid and MacLeish et al are primary references modified by other references or well-known principles.

In regard to the argument that changing the material of construction from graphite to silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy would defeat the intended purpose of McDiarmid and MacLeish et al, the examiner disagrees. It is true that McDiarmid and MacLeish et al supply RF energy to the susceptor in order to heat the susceptor via inductive heating. However, the materials claimed by the applicant can also be used for inductive heating. Thus changing the material of construction of McDiarmid and MacLeish et al from graphite to silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy does not defeat the intended purpose of the carriers. The examiner notes that Grabmaier et al teaches a polycrystalline silicon holder that is used as part of an inductive heater (figure 2), and McDiarmid teaches an inductive heating system or infrared lamp heating system, and that Inoue et al teaches a aluminum nitride holder for an infrared lamp heating system.

In regard to the argument that the selection of material is not simple, or obvious, the examiner disagrees. The selection of a material is a primary design criteria, and a basic part of any design process. One of ordinary skill in the art must determine the conditions to which the object i.e. holder will be exposed, and then select the proper material. If a cheap material i.e. graphite is not capable of functioning as required in a given environment then a more expensive material must be chosen. Graphite has been used for many years in the semiconductor processing apparatus art, and is well known for its susceptibility to chemical attack, which results in contamination of the processing environment. In fact, it is often coated with the claimed material to improve its chemical

resistance and other physical properties as is shown in the art of record. As a result, graphite has been replaced in the art by other more chemically inert materials such as those claimed by the applicant. Silicon carbide, aluminum nitride, large-grained polycrystalline silicon or silicon/silicon carbide alloy are all frequently used in the art as carriers because of their chemical resistance. Despite their higher initial cost, their longer life and less contamination of the product, results in a lower long-term cost.

In regard to the arguments directed to the Grabmaier et al or Inoue et al are moot because of the new grounds of rejection as discussed above. In the present rejections they are used only to teach specific materials of construction. The current rejections were made because the examiner believes they are better than the rejections made in previous office actions. However, the examiner believes that those rejections are still valid.

The examiner notes:

a. That crystalline silicon has two forms: a polycrystalline form, which contains two or more crystals, and single crystal form, which contains a single crystal. Either form can be machined to form a planar surface. Grabmaier et al differentiates between polycrystalline silicon, which he calls silicon, and single crystalline silicon, which he calls single crystal silicon. Thus, the silicon rod 1 is made of a polycrystalline silicon rod. (See column 2 lines 9-15, 41-45, and 58-72; and claims 1 and 4)

b. That Grabmaier et al teaches a silicon rod that acts as a wafer carrier, upon which are mounted a plurality supports (i.e. single crystalline silicon wafer)

and are heated by induction currents formed in the silicon rod to a temperature in which single crystal silicon can be formed on the support (wafer) by precipitation from a gas (i.e. CVD).

c. McDiarmid teaches that a wafer placed on a flat carrier will warp and is inherent in any system in which the wafer is supported on a flat wafer carrier (including those taught by Grabmaier et al and Inoue et al).

d. Inoue teaches an aluminum nitride holder having a composition of 97% aluminum nitride by weight. That is substantially made out of aluminum nitride. The holder of Inoue et al also has all the claimed thermal properties.

The rejections based on Haafkens et al and Chen et al have been dropped.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrie R. Lund whose telephone number is (703) 308-1796. The examiner can normally be reached on Monday-Thursday (6:30 am-6:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703) 308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

JEFFRIE R. LUND
PRIMARY EXAMINER